Discussion
on Main Report 2. and on the Co-Reports

ARANY, S.

General discussion

In harmony with the presented lectures and supplementing them, allow me to add some remarks to the knowledge of the alkali soils of the regions between the rivers Danube and Tisza.

These alkali (szik) soils of a very limy, very alkaline character, are — using the international nomenclature — of solonchaks and solonchak-solonetz types. Before their reclamation we should be acquainted with the factors and processes that have formed them and which still exercise an influence on these soils. These determine the dynamism of the alkali soil. Consequently, the possession of their knowledge could serve as a measure toward their reclamation and utilization.

I would like to point out that under Hungarian climatical and chiefly precipitate conditions really salty soils, the solonchaks, occur only in spots and only at those places, where the leaching-out process of the soil, and thus the removal of the soluble salts towards the deeper layers could not take place. — HERKE mentions at several places that on these kinds of alkali soils, even at a high level of the underground-water, a determined leaching-out process takes place.

About half a dozen years ago we had the pleasure to inspect these soils at several places of the above mentioned region with our dear guest, professor I. N. ANTIPOV-KARATAEV. Thus we studied these solonchak-like soils near Szeged, at Balástya, too. Although the soil profile did not show solonetz characteristics, professor ANTIPOV-KARATAEV recognized it. A few years later I had the opportunity to see the same profile which was open since years. It showed another aspect: it became structural. On the top, there was a light coloured very thin layer A of a few cm-s thickness. This lies on light coloured vertical shaped columns which are about 8—10 cm high (B Horizon). Without any doubt, this profile is of a solonchak-solonetz type which have developed due to the leaching effect of natural precipitates. — If the conditions are favourable for the removal of the displaceable constituents of the soil profile, a solonetz type of structural alkali soil arises which is poor in water-soluble salts in the top layer. This process might be performed before our eyes when the medium is neutral or nearly so.

The solonchak-solonetz types of the region between the Danube and Tisza rivers differ sharply from those of Hortobágy.

The reclamation of this type of alkali (szik) soil means quite a hard work. This appears from the lectures of S. HERKE and I. HARMATI. Notwithstanding their successful reclamation and utilization, the knowledge of their genetic type is necessary because this project outlines the possibilities of the success of the reclamation. A real picture however, could be obtained only through the knowledge of the subtype and the local variations as well as the local conditions of the soil.

The arrangement of the water-question is important: to control the surface and ground-waters. Besides the data gained at the profile on the field, it is necessary to the judgement of the reclamation and utilization of these soils to know the pH, the distribution of the (quantitative and qualitative) amount of the water-soluble salts through the soil profile, the phenolphtalein-alkalinity expressed as soda, the amount of lime ($CaCO_3$) and finally, the degree of the alkalinity (i.e. the sum of the equivalent percentage of the exchangeable + the % of the bicarbonatic sodium).

As a reclaiming agent, all materials are suitable which decrease the great alkalinity of the soil, and either with their own Ca-ions, or with those of the soil, can replace, to the desirable degree, the Na-ions of the alkali (szik) soil.

Generally, we use gypsum or materials containing gypsum for this purpose and also pulverised lignite, which cannot be used for heating boilers. The use of this material has been discovered by professor HERKE. He ascertained the mechanism, the processes the reclaiming effect, the durability of this reclamation material. He pointed out the

differences in the effects of these two materials (i.e. gypsum and lignite-powder). He applied the latter one for a certain kind of strongly alkaline, calcareous solonchak soils. Similarly, he worked out methods for the utilization of these soils for rice-production in connection with the use of lignite-powder on these kinds of alkali (szik) soils. Thus rice production has become possible on these sodic lands. This will be seen during the excursion, in the second part of this symposium. Likewise, HERKE worked out the method of growing *Puccinellia limosa* grasscover on the formerly strongly alkaline, barren solonchak pastures of the areas between the rivers Danube and Tisza. Thanks to the fruitful activities of professor HERKE, the formerly uncultivated lands to which I have referred several times, have become — at least partially — useful.

NAŻIR AHMAD

General discussion

In more than a dozen papers the successful results of the amelioration of soda lands have been discussed but no consideration has been given to the economics of the processes. This question is very important for Pakistan where an undeveloped alkaline land may be available for $ 100—200 per hectar but the cost of 20 tons of gypsum may run into more than $ 500, what no farmer can pay. Besides chemical amendments, it has been possible to reclaim alkali lands within 3 years with the method of deep ploughing with sufficient leaching water and green manuring along with crop-rotation at places where rice was grown. The economy of amelioration is an important question which needs careful consideration.

RAYCHAUDHURI, S. P.

General discussion

I would like to ask two questions from the Hungarian soil scientists:

1. I wonder whether in Hungary, in connection with drainage, pumping is necessary and is undertaken where the topography is flat. Pumping would increase the cost of reclamation considerably but it is essential for the effective drainage of water and salt in such cases.

2. I would like to know whether the different types of the alkaline and saline soil groups have different textures in the top soil and whether in planning the management of such soils, the texture of the surface soil is taken into consideration. This is important as the texture of the surface soil is a major factor in determining soil management.

VAN DER MEER, K.

General discussion

From the point of view of the economics of a reclamation scheme, the problem of costs is very important, to get a favourable cost — benefit ratio in the project. The costs involve among others the normal farm expenses, the costs of the chemical reclamation and the costs of the physical reclamation by irrigation and drainage layout. Topography of the area and the physical and hydrological soil properties play a very important part in the planning and execution of an adjusted irrigation and drainage layout. Therefore I should like to stress the importance of this type of research and investigation in the benefit of the economics of the project.

FINCK, A.

Ref.: paper by I. SZABOLCS

I. SZABOLCS has mentioned the use of calcium nitrate for decreasing alkalinity. Since, however, this is an alkaline nitrogen fertilizer, I want to ask whether acid fertilizers such as urea or ammonium sulphate have been tested in order to decrease alkalinity.

SZABOLCS, I.

In answer to the questions:

1. Calcium nitrate is more effective than ammonium sulphate but the latter is also effective.

2. The reclamation of saline and alkali soils is to be carried out with regard to economical aspects.

3. The physical and civil engineering aspects of the amelioration of these soils are to be taken into account. At solonetz soils the thickness of horizon A has a great importance from the viewpoints of amelioration.

YAALON, H.

Attention should be drawn to the coming International Hydrologic Decade under the auspices of UNESCO. Soil scientists should participate actively and those working with salt affected soils might profitably integrate salt balance studies with soil hydrologic investigations. The symposium could make recommendations to this extent in its resolution.

AUBERT, G.

Ref. : Recommandations

1. La 2. recommandation suggère que soit dressé à l'échelle du monde une carte des sols salés et à alcali. Il est probable qu'elle ne pourra être, au maximum qu'au 1/5 millionième. Je suppose qu'elle sera réalisée en liaison avec le groupe FAO/UNESCO chargé d'établir la carte des sols du monde et en utilisant, complétant et précisant les documents réunis par ce groupe.

2. (Après la remarque du Professeur ANTIPOV-KARATAEV au sujet du Sous-Comité pour les sols salés et à alcali, à l'intérieur de la 5^e Commission de l'Association Internationale de Science du Sol.)

Il me semble que notre recommandation peut difficilement demander la ré-création d'un sous-Comité de l'Association internationale de Science du Sol. Par contre il sera très facile que lors d'une réunion de la 5^e Commission au cours du Congrès de Bucarest, notre président puisse rendre compte de ce colloque et de nos recommendations, et, à cette occasion, demander que soit recréé le sous-Comité des sols salés et à alcali. J'y serai et je ferai de mon mieux pour l'aider dans ce sens.

RAYCHAUDHURI, S. P.

Ref. : Recommandation

Some agency should follow up these recommendations which should be communicated to important international organisations and different countries. To my mind UNESCO is the proper International Organisation to follow up these recommendations.

PRETTENHOFFER, I.

General discussion

As regards the question of drainage before the reclamation of solonetz soils on the strength of my experiments and practical experiences, the following reply may be given:

In the reclamation of non-carbonatic solonetz soils, too, drainage is the first thing to be done. The area to be reclaimed must not remain, of course, under the influence of ground-water. Solonetz soils which had been as hard as stone before reclamation when dry and pulpy when wet, and had had bad physical properties, after reclamation acquired a crumble structure and became permeable and easy to cultivate. After recla-

mation not only cereals but almost all kinds of field crops can be sucessfully grown. The cost of reclamation will be repaid in 3—4 years. On the strength of my experiments of 30 years, it may be emphatically stated that with one single reclamation practically permanent success can be obtained, as proved by the thorough chemical analyses of the profiles of our field experiments of long duration. These analyses have shown that the dynamics of the soil gradually tend towards the improvement of the deeper layers and this process can be hastened by subsoiling, i.e. deep cultivation of the soil without turning it over.